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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/622,403	07/18/2003	Richard C. Slater	1002-009.004	4136

57604 7590 10/03/2007

BAINWOOD HUANG & ASSOCIATES LLC
2 CONNECTOR ROAD
WESTBOROUGH, MA 01581

EXAMINER	
VAN ROY, TOD THOMAS	

ART UNIT	PAPER NUMBER
2828	

MAIL DATE	DELIVERY MODE
10/03/2007	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/622,403	SLATER, RICHARD C.	
	Examiner	Art Unit	
	Tod T. Van Roy	2828	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *20 July 2007*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-3,6-12,14-25,27-29,31,32 and 34-37* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-3,6-12,14-25,27-29,31-32,34-37* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Response to Arguments

Applicant's arguments filed 07/20/2007 have been fully considered but they are not persuasive.

The Applicant has argued that Chandra does not show an oscillator in which a light beam makes multiple passes through the array, and that no light that passes through a given element of the array passes through any other element of the array (Remarks, pg.3). The Examiner does not agree.

As can be seen in fig.1 of Chandra, the input light to the array is introduced on the left hand side from the beam combiner #14. This light is then introduced a first time to the array, strikes the end mirror #24 and re-enters the array for a second time completing a first round trip. The pumping light enters the symmetric array elements on the left producing a first electromagnetic (EM) field, then passes through the second row of array elements, strikes the mirror, and repeats the process in the opposite direction. Therefor, the light beams make multiple passes through the array, complete at least one round trip, and light from one element passes through at least an additional element.

The Applicant has further argued that the use of the phase conjugate mirror of Chandra within Tanuma would not be obvious. Again, the Examiner does not agree.

The use of the phase conjugate mirror is motivated along with the use of the array design of Chandra. The mirror itself is not meant to be used alone. The combination of using the mirror (for phase front degradation) and the array (energy scalability) was motivated.

The Examiner further notes that the Applicant has raised the issue of the conjugate mirror reducing divergence that may be an issue in an unstable resonator.

The Examiner concedes that this may be true, however, the use of the mirror provides for the use of the array for energy scalability as well as for an increase in brightness (Chandra, col.1 lines 55-60, previously cited passage). Therefor, although the divergence of the resonator may be somewhat reduced, the tradeoff is for higher energy scalability and increased brightness. As obvious reasons to try the mirror and array combination exist it is believed that a reasonable expectation of success would be present.

For the reasons stated above the combination of Tanuma in view of Chandra is believed to be both valid, and reasonable, to one of ordinary skill in the art.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.

4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

Claims 1-3, 6-7, 15, 17-22, 24-28, 31-32, and 34-37 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tanuma (US 5561550) in view of Chandra et al. (US 6052218).

With respect to claim 1, Tanuma teaches an unstable optical resonator (abs.) comprising a parametric gain medium (fig.1 #20) that produces a first electromagnetic field via pumping of laser light (abs.). Tanuma does not teach the use of multiple parametric gain media arranged on either side of a longitudinal axis. Chandra teaches a parametric amplifying system wherein multiple parametric gain media are evenly spaced around a longitudinal axis, produce respective overlapping electromagnetic fields, and whose output is in-phase via use of a phase conjugate mirror (fig.1). It would have been obvious to one of ordinary skill in the art at the time of the invention to combine the unstable parametric resonator of Tanuma with the multiple parametric gain media and alignment of Chandra to take advantage of large energy scalability (enabling use of high power pumping, abs.), as well as to incorporate the use of a phase conjugate mirror to reduce phase front degradation and beam divergence (col.1 lines 55-60).

With respect to claim 2, Tanuma further discloses an output beam existing said unstable resonator (fig.1 L2).

With respect to claim 3, Tanuma and Chandra further teach the output beam has an intensity proportional to an amplitude product squared, said amplitude product being an amplitude of said first electromagnetic field multiplied by an amplitude of said second

electromagnetic field (beam is amplified at each gain element, product then output at end of the resonator).

With respect to claims 6-7, Tanuma and Chandra teach the system as outlined in the rejection to claim 6 above, including the importance of gain spacing (Chandra, for overlap) but does not specify the separation distance be about 1mm. It would have been obvious to one of ordinary skill in the art at the time of the invention to optimize the range through experiment as this has been shown to be within the skill of a general worker in the art (see MPEP 2144.05 II A - In re Aller, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955) – speaking of the fact that it is not inventive to discover the optimum or workable ranges by routine experimentation, i.e. changing the spacing between the gain media).

With respect to claims 15 and 17, Tanuma further teaches the use of Lithium Niobate (col.1 lines 22-28).

With respect to claims 18-19, Tanuma and Chandra further teach the use of at least 4 gain media in a 2x2 array (Chandra, fig.1, abs., taught to be scalable).

With respect to claim 20, Tanuma and Chandra further teach the unstable resonator to be negative or positive branch (inherently one or the other).

With respect to claims 21-22, Tanuma further teaches the resonator is confocal-convex (fig.1).

With respect to claim 24, Tanuma and Chandra teach a method of coherent beam combination as is taught by the system outlined in the rejection to claim 1 above.

With respect to claim 25, Tanuma and Chandra further teach the output beam has an intensity proportional to an amplitude product squared, said amplitude product being an amplitude of said first electromagnetic field multiplied by an amplitude of said second electromagnetic field (beam is amplified at each gain element, product then output at end of the resonator).

With respect to claims 27-28, Tanuma and Chandra further teach producing a third electromagnetic field (Chandra, fig.1, at least 8 fields produced in this embodiment), and expanding said third electromagnetic field in said unstable resonator to coherently combine the third field with the first and second fields (due to overlap).

With respect to claim 29, Reilly further discloses removing heat from the gain media (fig.17).

With respect to claims 31-32 and 34-35, Tanuma and Chandra further teach the at least two gain media are located near the midpoint of the distance between first and second mirrors of the unstable resonator, and near the midpoint of the length of the resonator (fig.1 #20, fig.4 #20, near midpoints).

With respect to claims 36-37, Tanuma and Chandra further teach the unstable resonator has a circular cross section (Tanuma, fig.2, as taught by applicant's figs.2/4), and the unstable resonator includes a convex mirror (fig.2 #42) and a concave mirror (fig.2 #41), with the gain medium disposed between the two (fig.2 #20).

Claims 8-12 and 29 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tanuma in view of Chandra and further in view of Mooradian (US 5115445).

With respect to claims 8-12 and 29, Tanuma and Chandra teach the system as outlined in the rejection to claim 1 above, but do not teach a heat conducting element to be found in contact with the gain media in a transverse plane contacting a portion of the gain media parallel to the longitudinal axis and made of optical quality diamond. Mooradian teaches an unstable resonator (col.6 lines 50-53) wherein an optical quality diamond is used to remove heat from the gain media (col.5 lines 15-29, obvious the diamond is of optical quality as it is directly in the beam path, fig.1 #16). It would have been obvious to one of ordinary skill in the art at the time of the invention to combine the system of Tanuma and Chandra with the optical quality diamond material of Mooradian as diamond is known to have a good heat conductivity (col.5 lines 20-25) and additionally to use the alignment of the heat conductors of Mooradian as the material would not negatively impede the electromagnetic fields (lying in a transverse plane, and touching a portion of the plane parallel to the longitudinal axis-at the corner).

Claims 14, and 16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tanuma and Chandra in view of Velsko et al. (US 6421166).

With respect to claims 14, and 16, Tanuma and Chandra teach the system as described in the rejection to claim 1 above, but do not teach the use of parametric gain media. Velsko teaches an unstable resonator (claim 8) wherein PPLN (col.2 lines 50-53) is used. It would have been obvious to one of ordinary skill in the art at the time of the invention to combine the system of Tanuma and Chandra with the parametric gain media of Velsko to achieve highly efficient frequency conversion (col.1 lines 55-62) for

use in industrial applications where specific wavelengths are needed and can be combined with the unstable resonator's high output power, as well as the ability of the media to provide gain in the resonator.

Claim 23 is rejected under 35 U.S.C. 103(a) as being unpatentable over Tanuma and Chandra in view of Sziklas (US 4170405).

With respect to claim 23, Tanuma and Chandra teach the system outlined in the rejection to claim 1, but do not teach the use of a ring resonator. Sziklas teaches an unstable resonator ring resonator (fig.5). It would have been obvious to one of ordinary skill in the art at the time of the invention to combine the system of Tanuma and Chandra with the resonator design of Sziklas in order to allow for easy adjustment of cavity length and mode control.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Tod T. Van Roy whose telephone number is (571)272-8447. The examiner can normally be reached on M-F.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Minsun Harvey can be reached on (571)272-1835. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

TVR